Optimizing Healthy Child Development

Life Course Health Development:
A Framework for Transforming Health & Health Care

Neal Halfon MD MPH
Professor of Pediatrics, Health Services, Public Policy
UCLA Center for Healthier Children Families and Communities

August 7, 2019
Diabetes in Indian Country
Oklahoma City, Oklahoma

Center for Healthier Children, Families & Communities

SYSTEMS INNOVATION & IMPROVEMENT

We work with local, state, and national partners to develop responsive systems of care and to bridge the gap between what we know and what we do.

TRAINING & MODEL PROGRAMS

We provide interdisciplinary training to health professionals preparing them to reshape health services and policies in order to improve children's long-term development.

RESEARCH & EVALUATION

We study how both risk and protective factors influence children's outcomes, and apply the latest knowledge to programs, community systems, and state and national policy.

POLICY

We provide analysis that are crucial to creating policies that optimize early childhood outcomes and manage chronic disease. We collaborate with policymakers in California, Washington, D.C., the UK, Canada, and Australia.

CHCFC -Current Projects

All Children Thrive is a global network of people and places working together to identify the strategies and policies that can help all children thrive.

ACT California is transforming cities into microenterprise of social innovation, creating the conditions where families flourish and children thrive. $10 million allocated by California legislature to engage 40 cities in next 2 years

Transforming Early Childhood Community Systems is a national initiative to improve school readiness of children by measuring and mapping developmental progress. Working with over 70 places across the US.

The **Gross Domestic Potential** Project aims to create a new measurement framework for how we as a nation measure the opportunities, capabilities and potential of a child across the life course and determine what investments communities should make to maximize this potential.

Moving Health Care Upstream is a collaborations with Nemours to design new ways of engaging health systems in addressing social and developmental determinants of health

Life Course Research Network is a collaborative network of researchers and MCH professionals committed to improving health and reducing disease by advancing life course health development research.

LCHD as a catalyst for transformation

- Life Course Health Development – LCHD – is analytic framework or model, used to make sense of the world,
- Diabetes is one of several health problems that is more prevalent in Native Americans
- LCHD provides a new way thinking about Diabetes connecting the dots between past, present and future,
- LCHD explains how health and disease develop across the life course and across generations
- LCHD focuses on the multiple ways risks and protective factors get under our skin during sensitive periods of development and get programmed into our behaviors and biology

LCHD- Incremental, Disruptive, & Transformative Change

- LCHD is helpful in rethinking and redefining
  - 1.0 medical care system can do to enhance prevention
  - 2.0 health care system can do to enhance health promotion
  - 3.0 health system does to optimize health development
- LCHD is useful in considering the culturally coherent developmental scaffolding needed to
  - Respond to and buffer the effects of historical trauma
  - Advance decolonizing methodologies and strategies
  - Redefine 1.0 clinical strategies into 3.0 health development ecosystems
  - Prioritize and position cultural revitalization as part of life course strategies that optimize health development
- LCHD can provide a way of transforming practice, systems, policy and reaching the 3rd Horizon

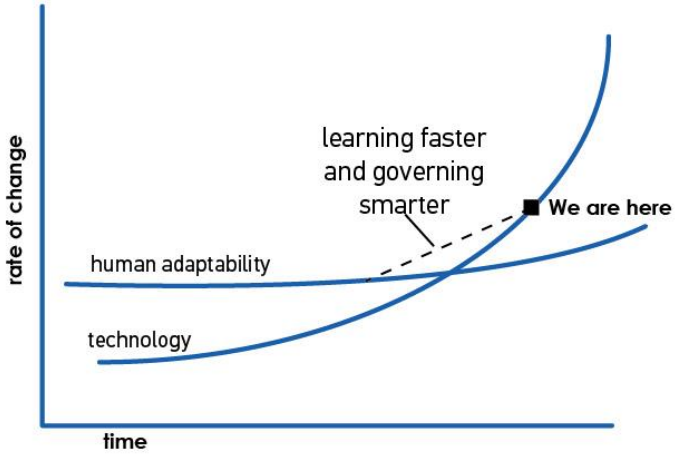
LCHD – Setting the Stage

- Big Complex Changes Underway (social, cultural, economic, environmental)
- Major Adaptive Challenges
- Responding Requires Transformative Approaches
- New Paradigms and Frameworks to Help Us Make Sense, Plan, Strategize & Act
- Complex Adaptive Systems Science
- Life Course Health Development & 3.0 Transformation Framework are new ways of making sense
- New Frameworks inform New Strategies,

Deep Drivers of New Forms of Adversity

- Change of age (economies/ production ecosystems)
  - agriculture> industrial> digital
- Major disruptions in our social ecosystems
  - cultural forms, value streams, production models, relationship to environment/planet
- Accelerators of change
  - Globalization X Technology X Climate Change
- Speed of change is increasing (faster than we can adapt to; disease and disability due to adaptive failures)
- Mismatches –mismatch diseases like obesity, mental health problems, addictions on the rise

The Adaptive Challenge of our Age

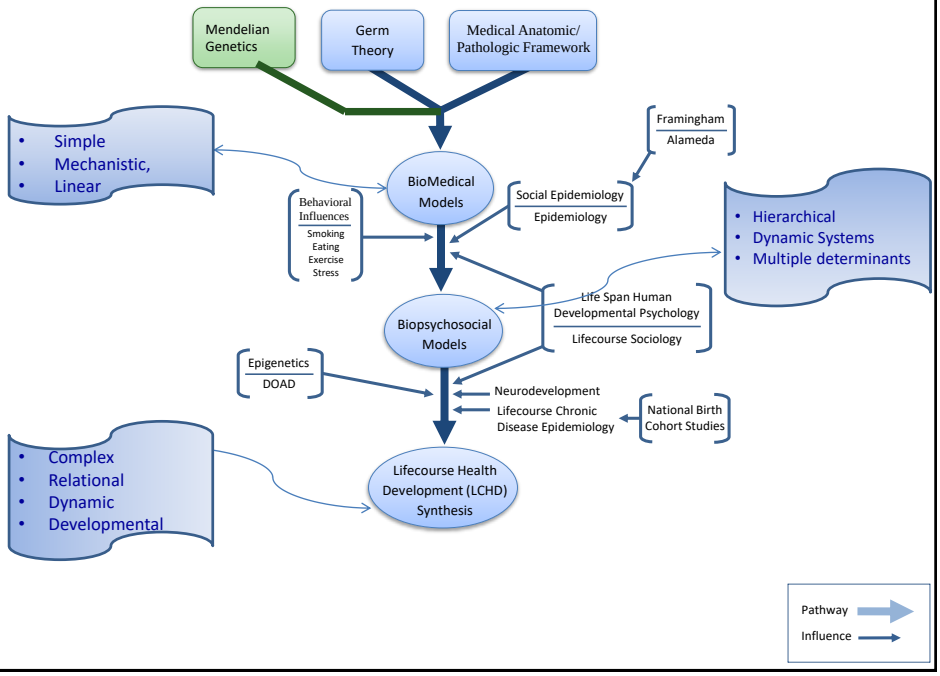


Tom Friedman: Thank You For Being Late

New Frameworks & New Strategies

- Respect the dignity of people, culture, ecosystems in a sympathetic and useful way
- Focus on assets, ecosystem value, resilience
- Enhance capabilities to escape the pull of historical trauma, and structural inequalities
- Identify & leverage root causes,
- Build connections between individual, interpersonal, institutional, community, and policy levels and approaches
- Explain mismatches between who we are and the world we are creating (mismatch diseases)

Evolving Conceptual Models of Health

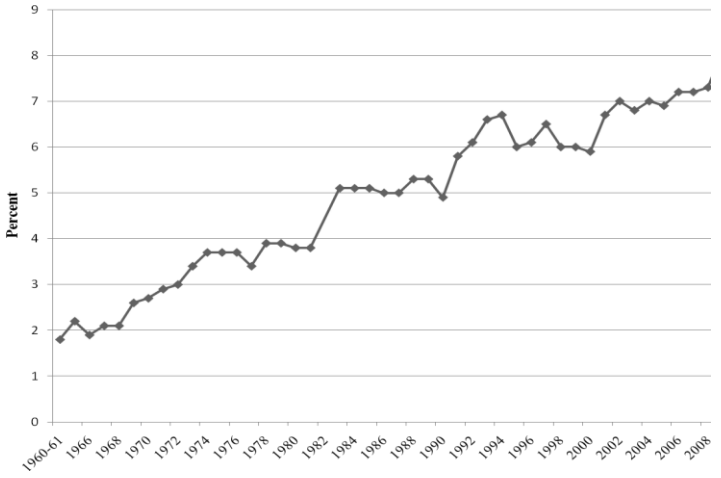


Changing Pattern of Childhood Morbidity

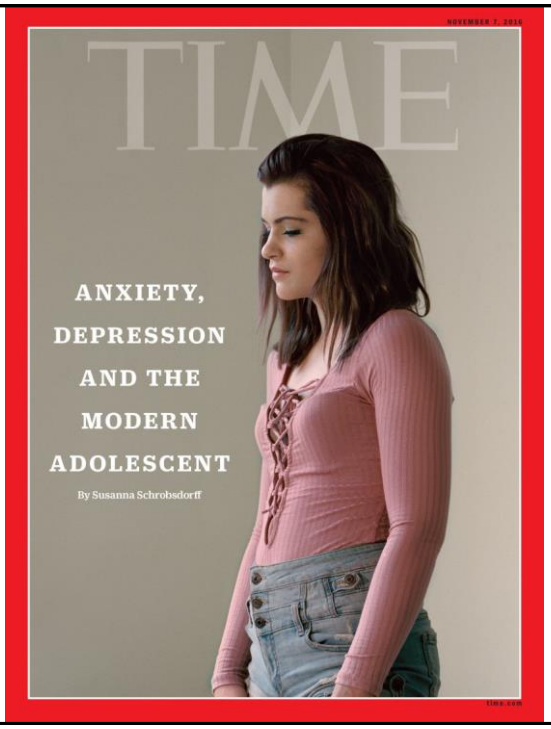
- Increase in chronic health problems (40%)
  - Not Hemophilia, Cancer, Congenital Heart Disease
- Obesity, Metabolic Syndrome, Diabetes (19%)
- Growing prevalence of mental health disorders (22+%)
- Greater appreciation of role and impact of neuro-developmental health problems – learning, language (10-17%)
- Growing number of children with multiple conditions (co-morbidities) e.g. asthma, obesity, ADHD

Trends in Childhood Disability- U.S.

(Limitation of Activity due to Chronic Conditions for U.S. Children, NHIS, 1960-2009)



From Halfon, Houtrow, Larson, Newacheck Future of Children 2012



15

What's Killing Our Children?

Child and Infant Mortality among American Indians and Alaska Natives

A National Academy of Medicine Discussion Paper

Unintentional injuries represent **41%** of all deaths among American Indian and Alaska Native children

Across all age groupings, deaths of American Indian and Alaska Native youth are **2-4 X** higher than for white youth

The overall American Indian and Alaska Native death rate for SIDS among infants is **more than double** that for the non-Hispanic white population

SIDS: Sudden Infant Death Syndrome

Policy-level interventions with potential to make a dramatic impact

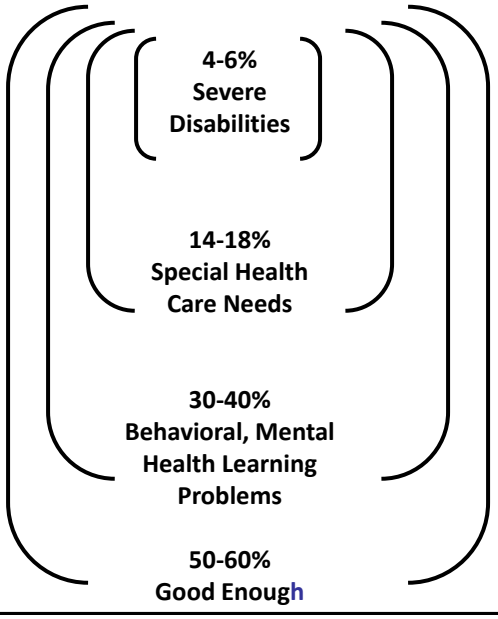
- Alcohol control policies
- Motor vehicle policies
- Supportive breastfeeding policies
- Gun control policies
- Cultural preservation programs

@theNAMedicine

nam.edu/Perspectives

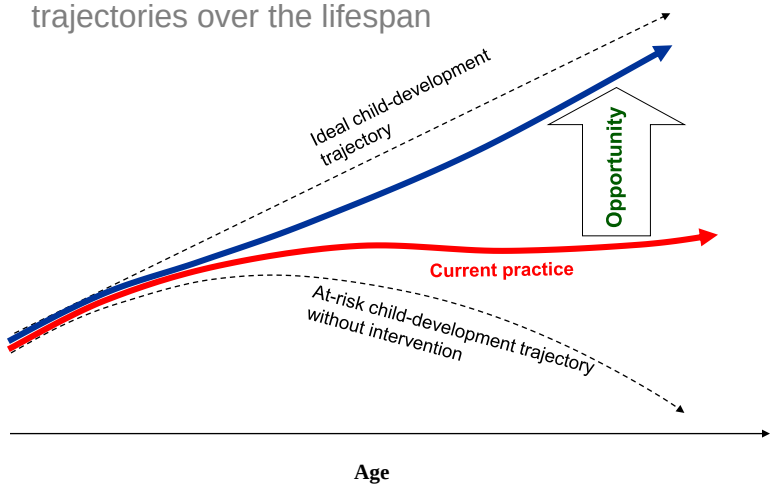
16

Children & Adolescents at Risk

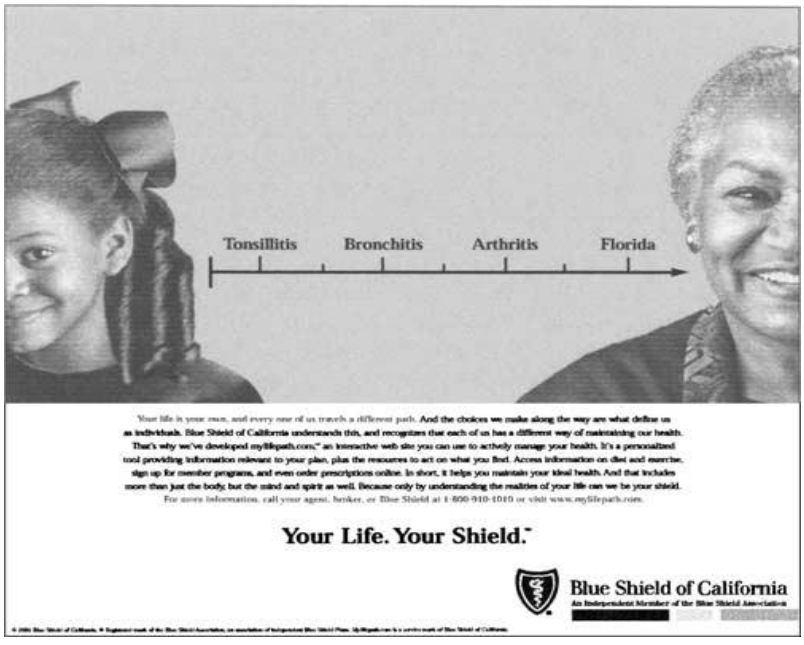


Not Optimizing Healthy Development

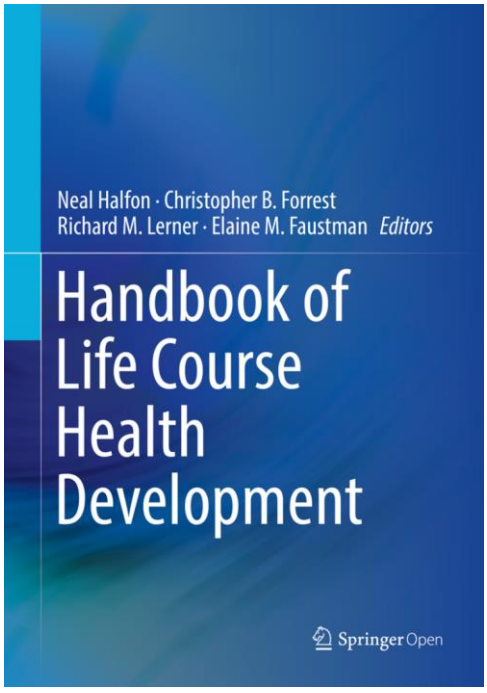
Addressing the factors shaping health development trajectories over the lifespan



Evolving Notions: Life Course & Health




Lifecourse Health Development: Past, Present and Future
Neal Halfon · Kandyce Larson · Michael Lu · Ericka Tullis · Shirley Russ
Systems Strategies for Better Health Throughout the Life Course
A Vital Direction for Health and Health Care
FRAMEWORK FOR POPULATION HEALTH
By Neal Halfon, Peter Long, Debbie I. Chang, James Hester, Moira Inkelas, and Anthony Rodgers
ANALYSIS & COMMENTARY
Applying A 3.0 Transformation Framework To Guide Large-Scale th System Reform
CLINICAL INVESTIGATIONS
Effect of Health Protective Factors on Health Deficit Accumulation and Mortality Risk in Older Adults in the Beijing Longitudinal Study of Aging
September 19, 2016
omics of human longevity
THE NEW ENGLAND JOURNAL of MEDICINE
ORIGINAL ARTICLE
Lifetime Risks of Cardiovascular Disease
ABSTRACT
RESEARCH ARTICLE
Open Access
Life course socio-economic position and quality of life in adulthood: a systematic review of life course models
BMC Public Health


Neal Halfon · Christopher B. Forrest
Richard M. Lerner · Elaine M. Faustman Editors
Handbook of Life Course Health Development
SpringerOpen

Life Course Health Development

- Defines Health as a developmental process
- Builds Upon a rapidly Expanding Evidence Base
  - Life Course Chronic Disease Epidemiology
  - Neurobiology
  - Early Adversity and Early Intervention Research
  - Developmental Toxicology and Epigenetics
- Not just connecting the dots between early exposures and later or latent manifestations of those exposures
- Elucidating the mechanisms by which physical, social, emotional environment is embedded into developing bio-behavioral regulatory systems

Life Course Chronic Disease Epidemiology: Barker Hypothesis

- Barker ran the MRC Environmental epidemiology unit in South Hampton
- Conducted Historical Cohort Studies of CVD
- Key Finding: Fetal growth and development, and other factors, in first year(s) of life related to cardiovascular and other chronic disease in the fifth and sixth decade
- How did he discover this?
- Why it challenged prevailing orthodoxy?

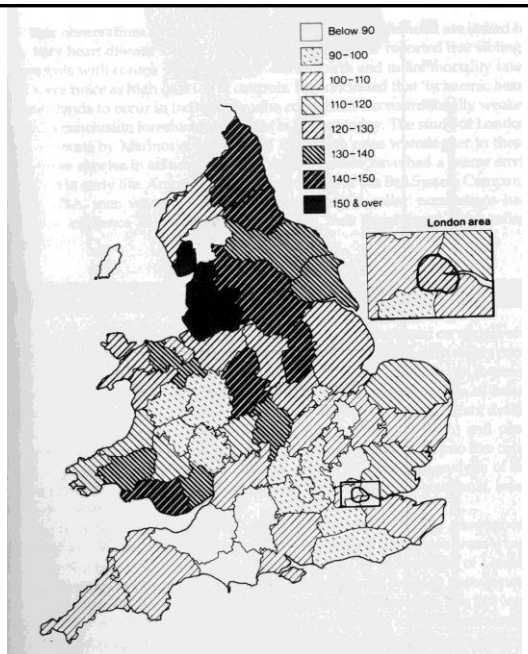


Fig. 1.3 Infant mortality rates per 1000 births in England and Wales during 1901–10.

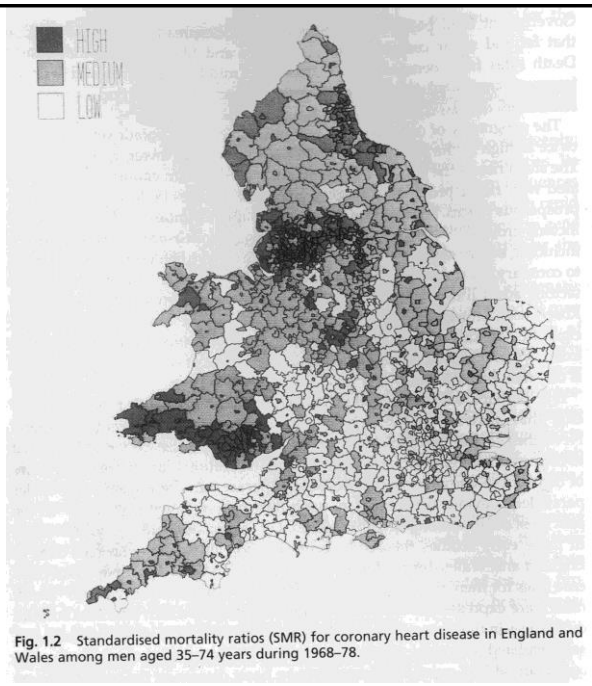
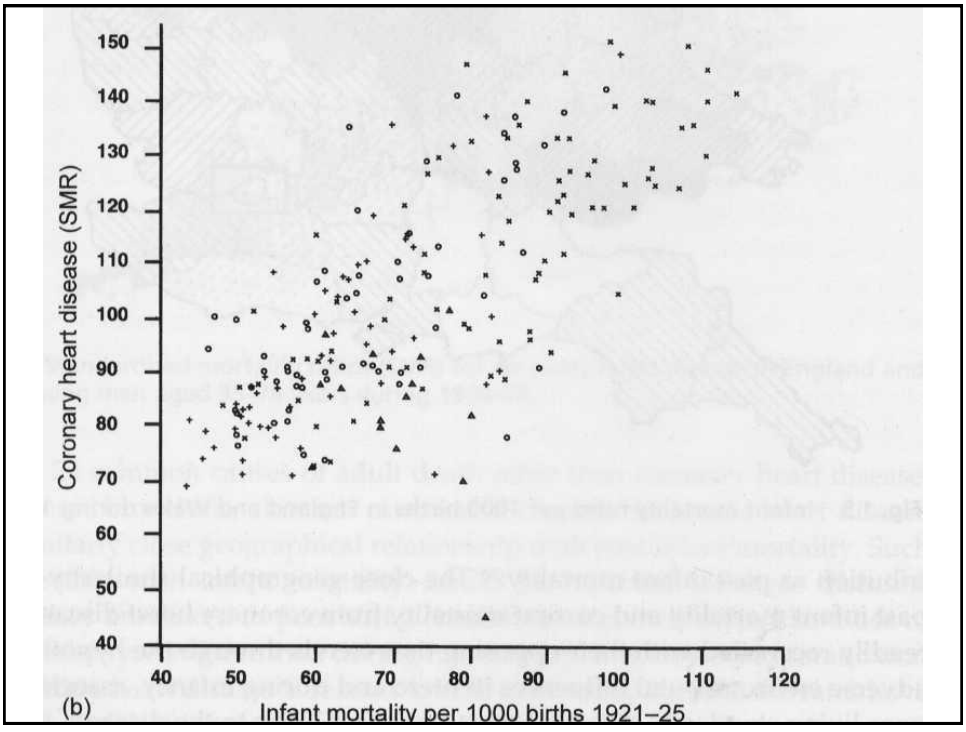
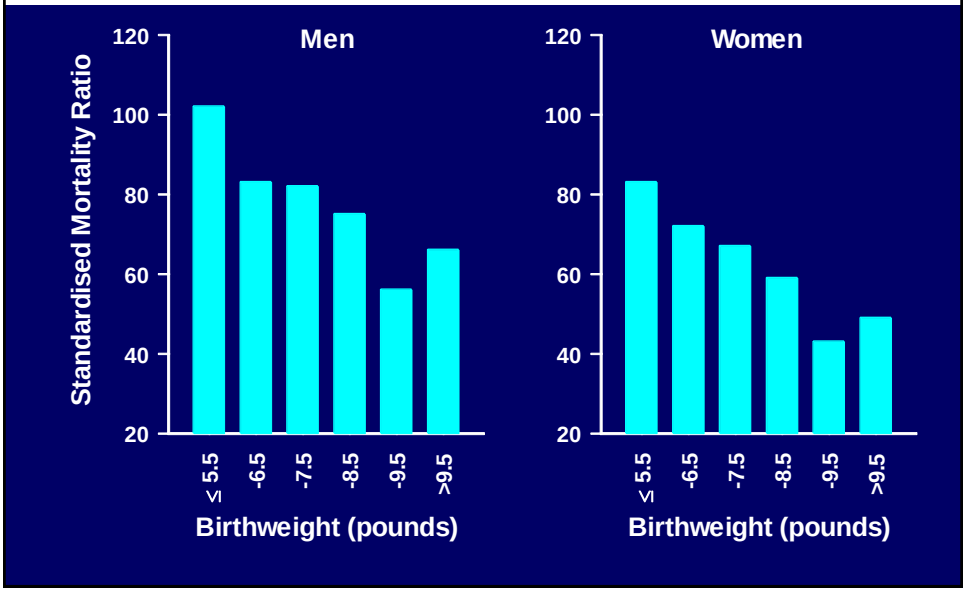


Fig. 1.2 Standardised mortality ratios (SMR) for coronary heart disease in England and Wales among men aged 35–74 years during 1968–78.



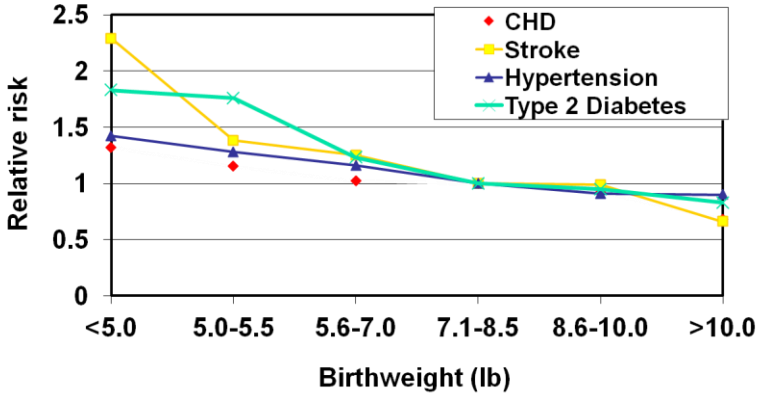
Mortality from coronary heart disease in 15726 men and women in Hertfordshire



Life Course Chronic Disease Epidemiology: Barker Hypothesis

- Barker challenged that CVD was just due to cumulative risks: diet, smoking, exercise, life style,
- Suggested that something was being programmed very early on that might be latent
- He argued that nutrition or in some cases malnutrition was having an affect on evolutionary determined plasticity of development
- Fetus was being signaled that the environment might not be very nourishing, so it better reprogram its metabolism to be adaptive to this less than nurturing world

Birth weight and CVD Outcomes
Nurses' Health Study



Curhan et al., Rich-Edwards et al.

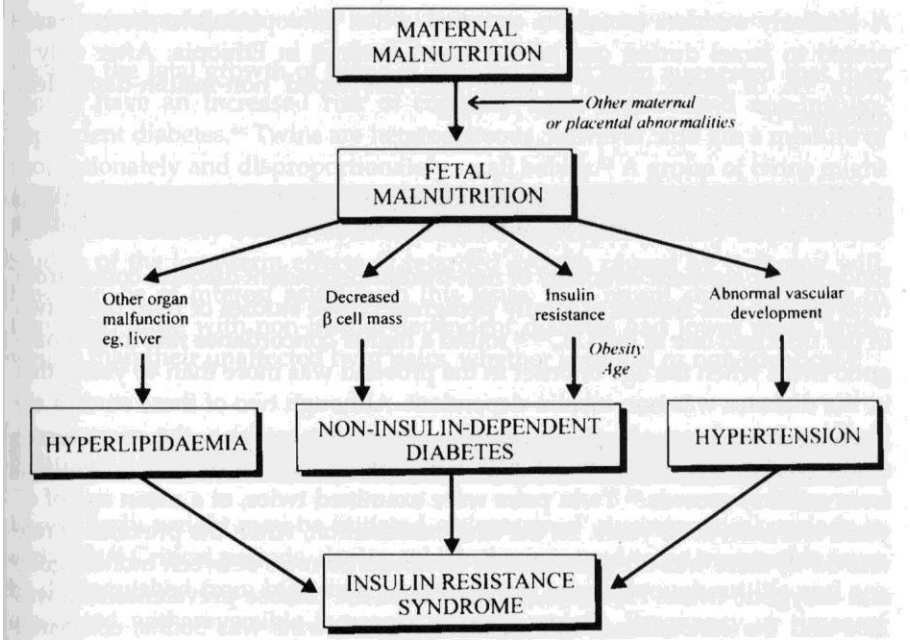


Fig. 6.3 The fetal origins of non-insulin-dependent diabetes and insulin resistance syndrome: the 'thrifty phenotype' hypothesis.

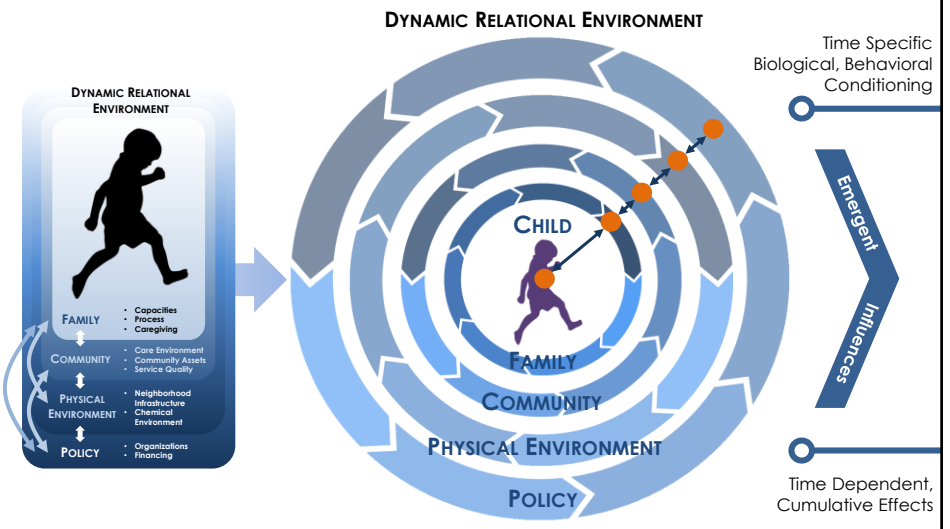
Down Stream Health Problems Related to Early Life

2nd Decade	3rd/4th Decade	5th/6th Decade	Old Age
• School Failure	• Obesity	• Coronary Heart Disease	• Premature Aging
• Teen Pregnancy	• Elevated Blood Pressure	• Diabetes	• Memory Loss
• Criminality	• Depression	•Renal Disease	
•Substance abuse		•Arthritis	
•Anxiety Disorders			

From Hertzman

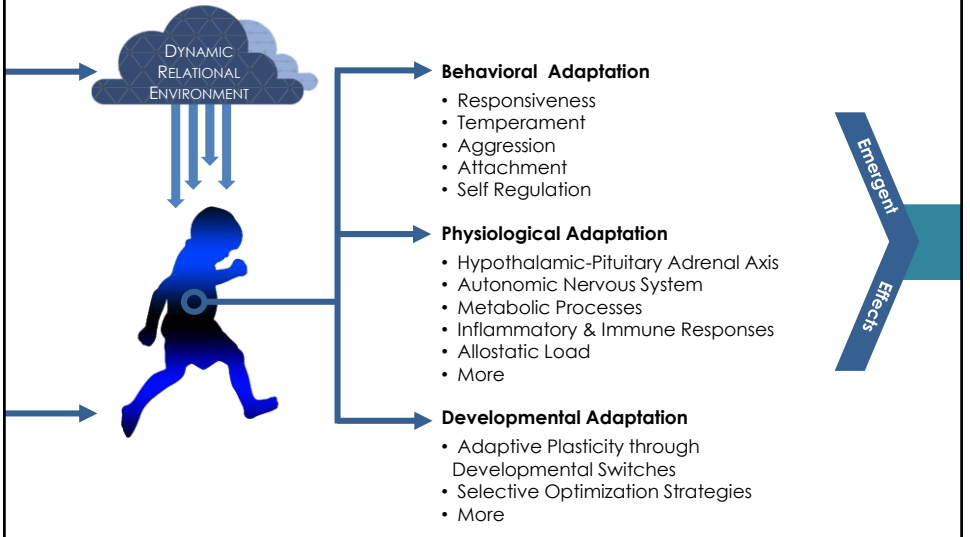
Changing Contexts of Health Development:

Multiple Factors, Dimensions, & Levels Dynamically Transacting



Variable Adaptive Responses:

Plasticity & Optimization of Regulatory Processes



Dynamics of Health Development:
Phases, Trajectories and Outcomes

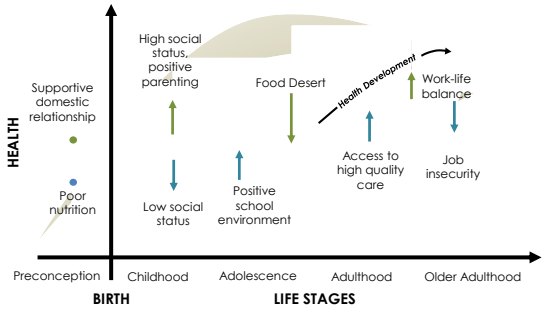
HEALTH DEVELOPMENT TRAJECTORIES

Patterns of changes in health assets over time, affected by environmental and intrinsic factors.

1 LATENT EFFECTS
Resulting from experiences, particularly during sensitive periods, that influence health later in life.

2 CUMULATIVE EFFECTS
Resulting from experiences that accumulate over time & manifest in health.

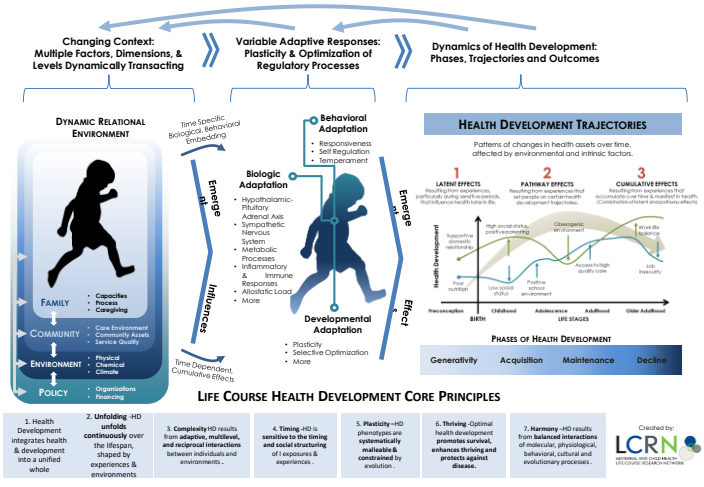
3 PATHWAY EFFECTS
Resulting from multiple, converging environmental and genetic influences, regulated by an array of specific developmental switches that set people on certain health development trajectories. (Combination of latent & cumulative effects)



PHASES OF HEALTH DEVELOPMENT

Generativity | Acquisition | Maintenance | Decline

LIFE COURSE HEALTH DEVELOPMENT



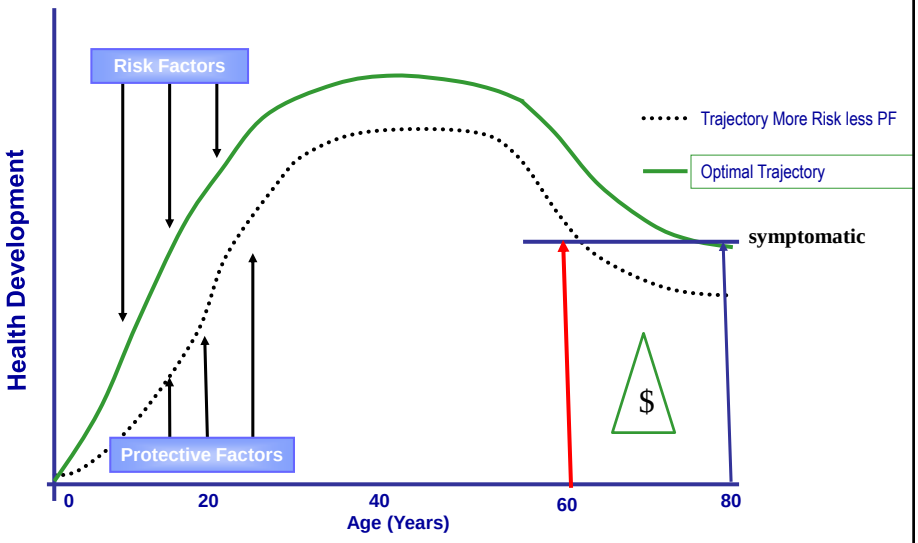
LCHD: Principles

- Health Development (HD) integrates the concepts of health and development into a unified whole
- Unfolding – HD unfolds continuously over the lifespan, shaped by experiences an environmental interactions
- Complexity – HD results from adaptive, multilevel, and reciprocal interactions between individual and their physical, natural, & social environments
- Timing – HD is sensitive to the timing and social structuring of environmental exposures and experiences

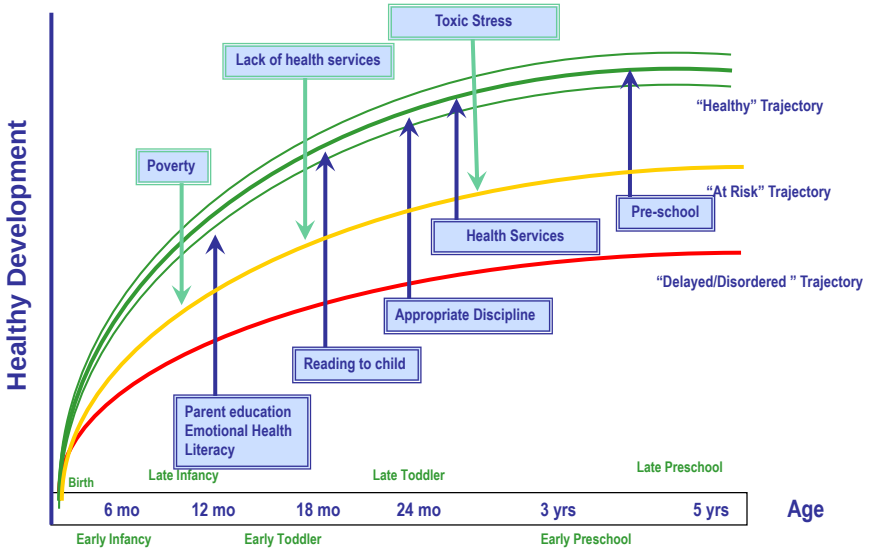
LCHD: Principles (cont)

- Plasticity- HD phenotypes are systematically malleable and enable and constrained by evolution to enhance adaptability to diverse environments
- Thriving – Optimal HD promotes survival, enhance thriving, and protects against disease
- Harmony – HD results from balanced interactions of molecular, physiological, behavioral, cultural and evolutionary processes

How Risk and Protective Factors Influence Health Development



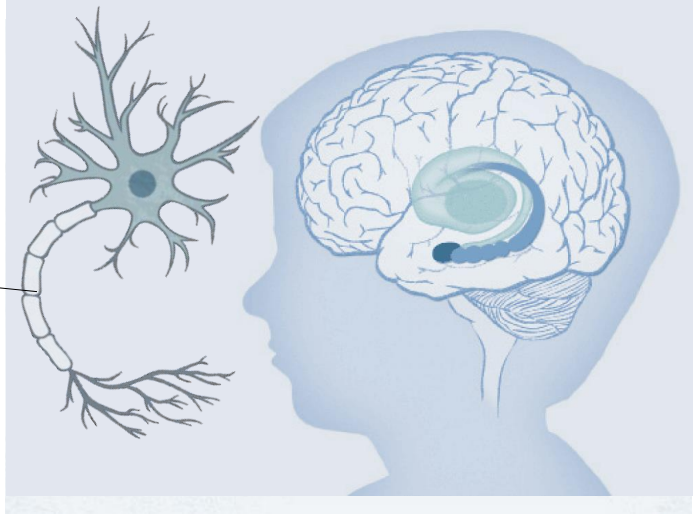
Reducing Risk & Optimizing Protective Factors



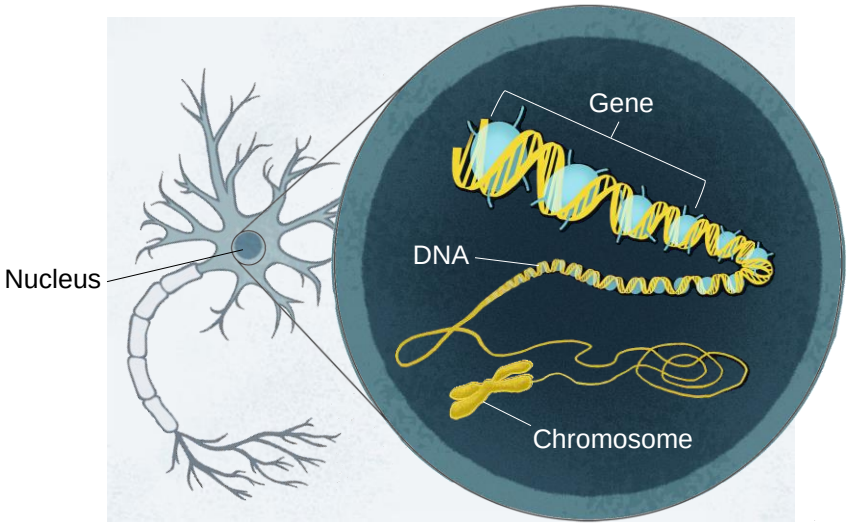
Building Healthy Brain Architecture – The Ingredients

- Takes more than having the right genes
- Takes the right, supportive experiences
- Experience literally writes on our genes, determining how well our genes work

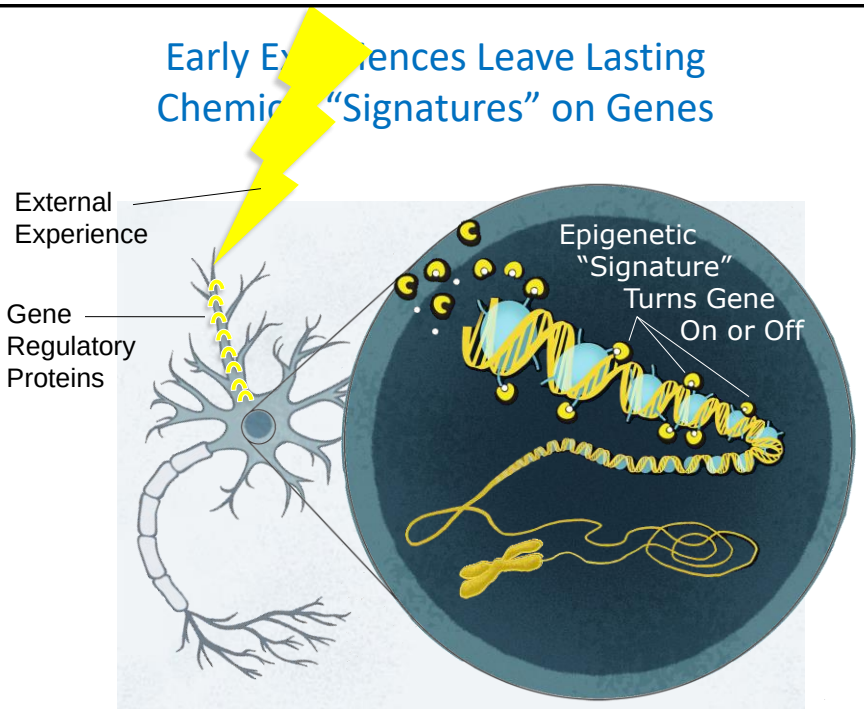
How Early Experiences Alter Gene Expression and Shape Development



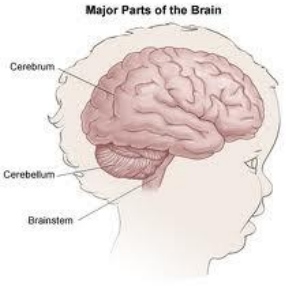
Genes Carry Instructions that Tell Our Bodies How to Work



Early Experiences Leave Lasting Chemical "Signatures" on Genes



Environment Influences Regulation of Gene Expression Beginning Before Birth



Stimulation is Needed In Order for the Brain To Develop

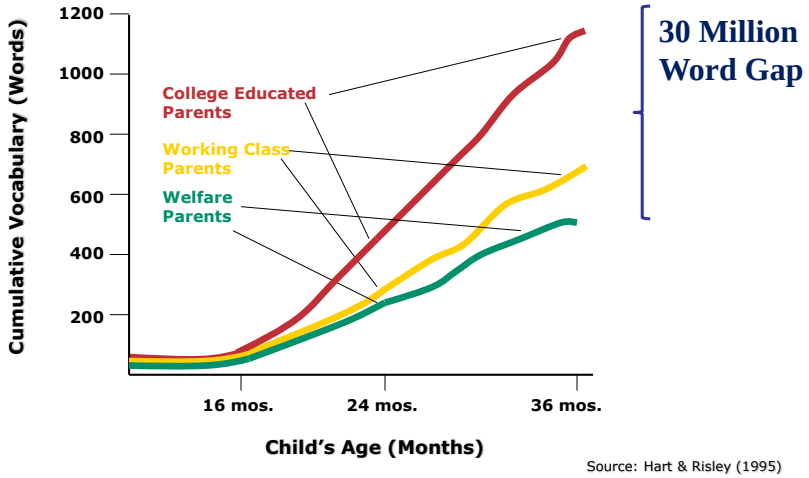
Human Infant is Unable to Provide Itself Adequate Stimulation for Normal Brain Development

The Brain Develops in the Context of Relationships

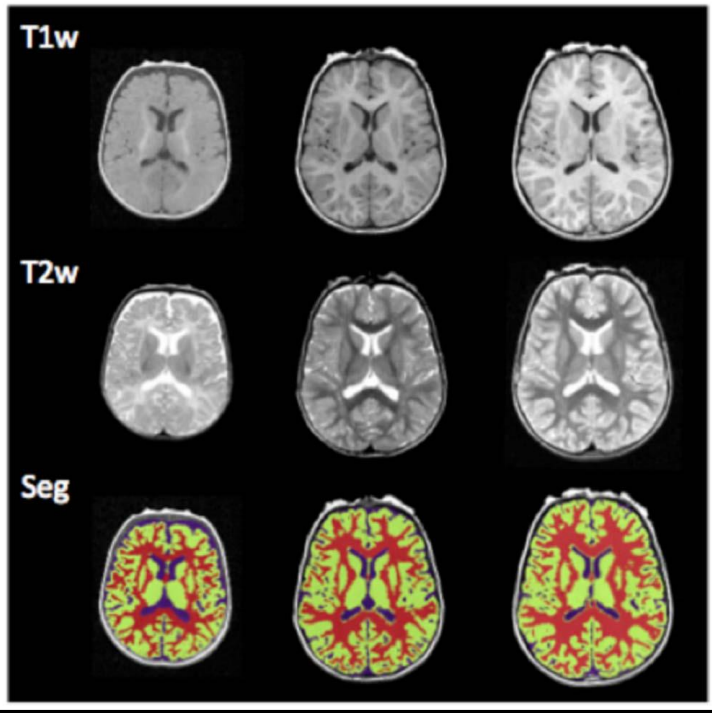
Socioeconomic Adversity and Child Health

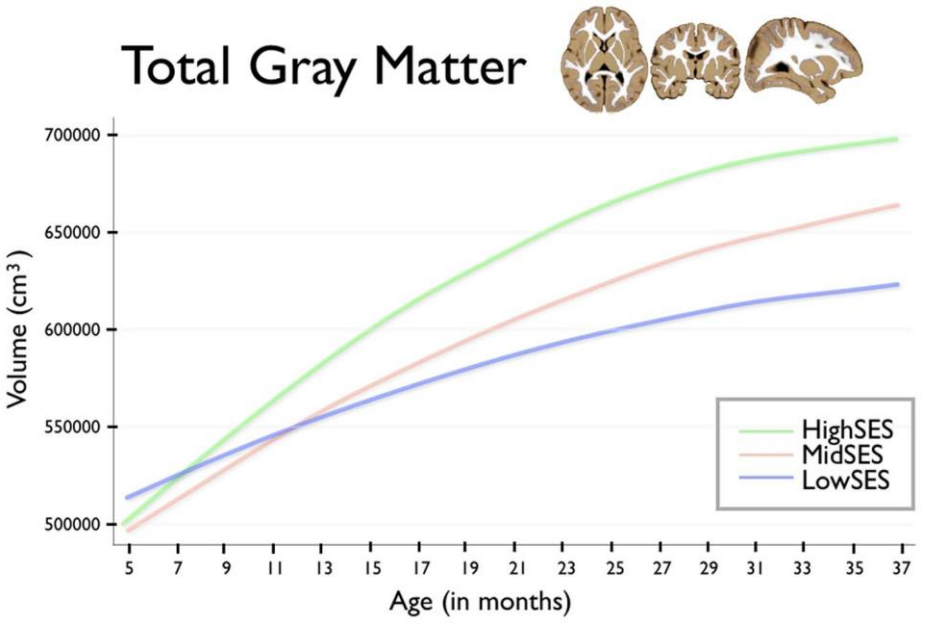
- Born early, smaller, more fragile, and at risk
- Worse physical, cognitive, emotional health
- Hospitalized more, more obese, more asthma, more mental health problems, more disability
- Lower health trajectories, greater brain drain
- Carry the burden of their social status into adulthood
- Programmed into how their biology – an how their immune, endocrine, neurological systems develop, function and perform

Difference in Functional Brain Development: Start Early & Compound Over Time

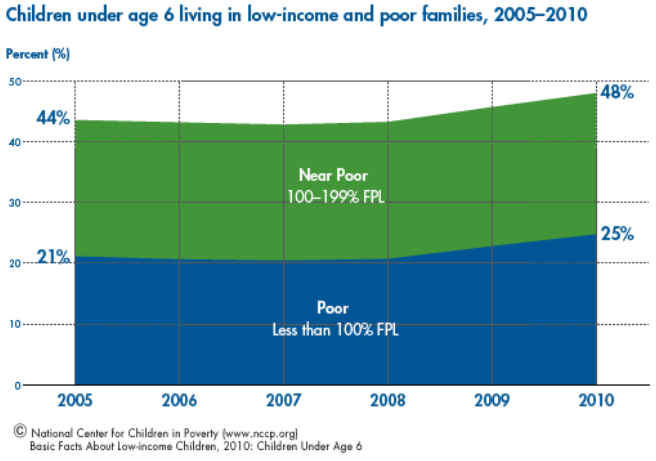


Source: Hart & Risley (1995)

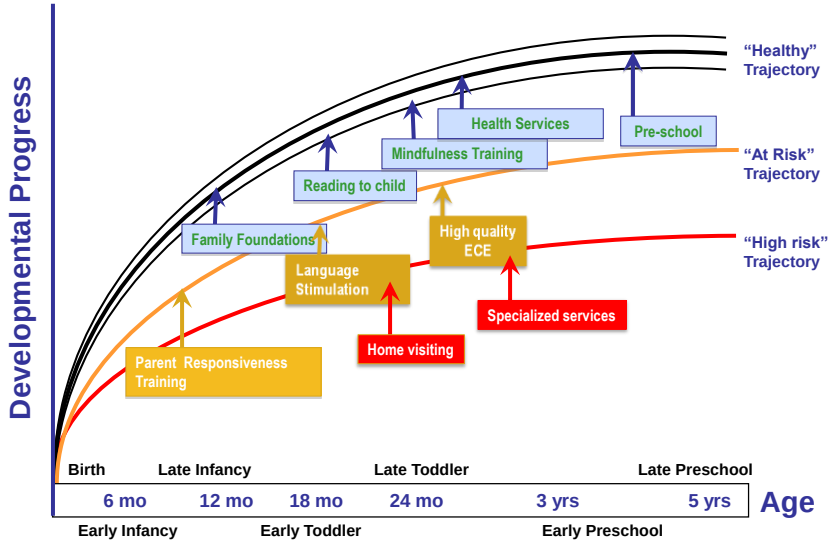




Hanson et al, Poverty & Brain Growth, PLOS One 2013

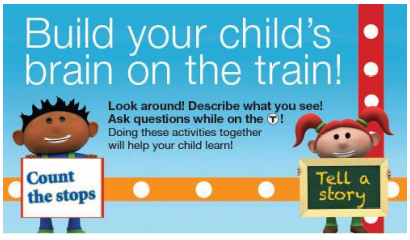


Strategies to Improve Developmental Trajectories

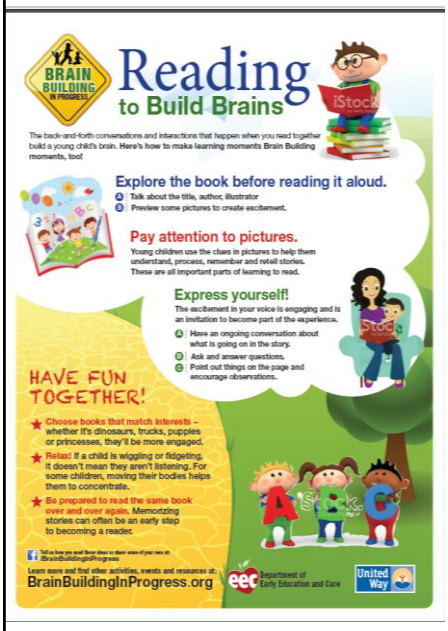


Any moment can be a Brain Building moment!

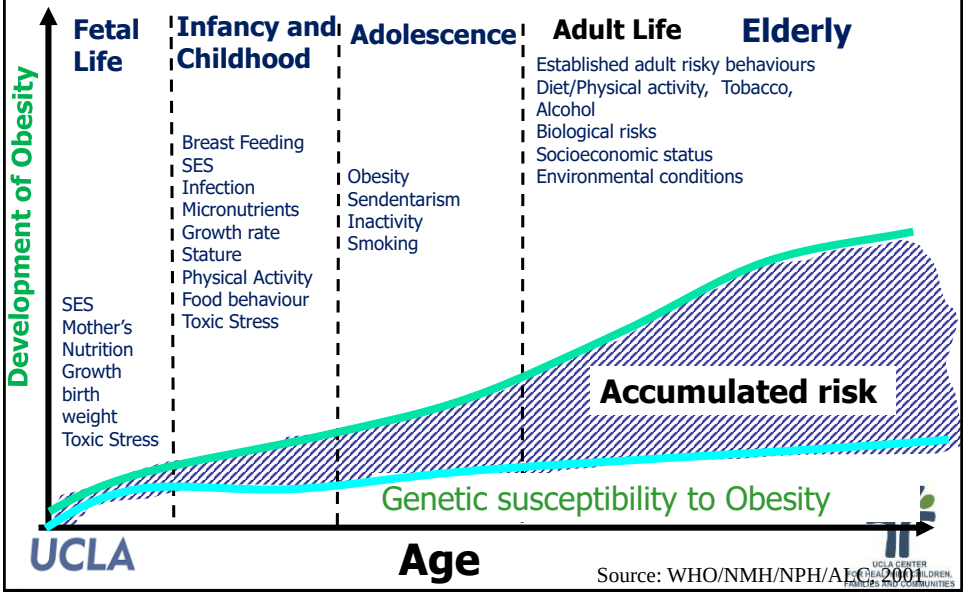
Whether you are at the grocery store counting fruits and finding colors…



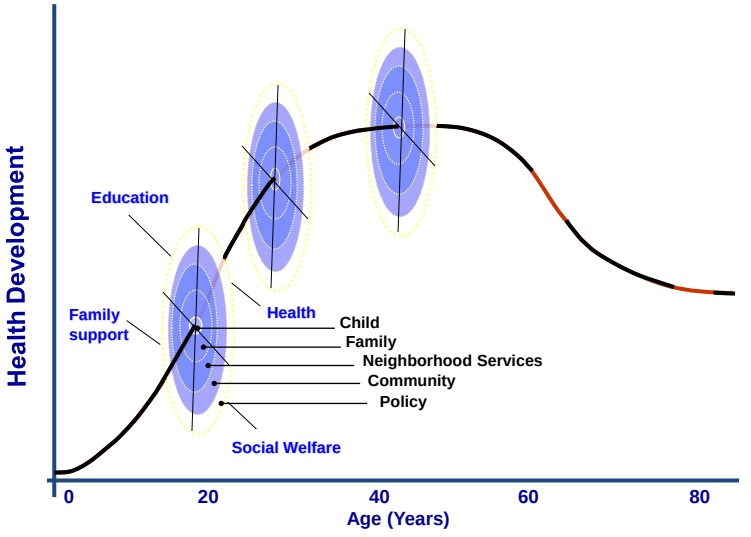
…or riding a train or bus

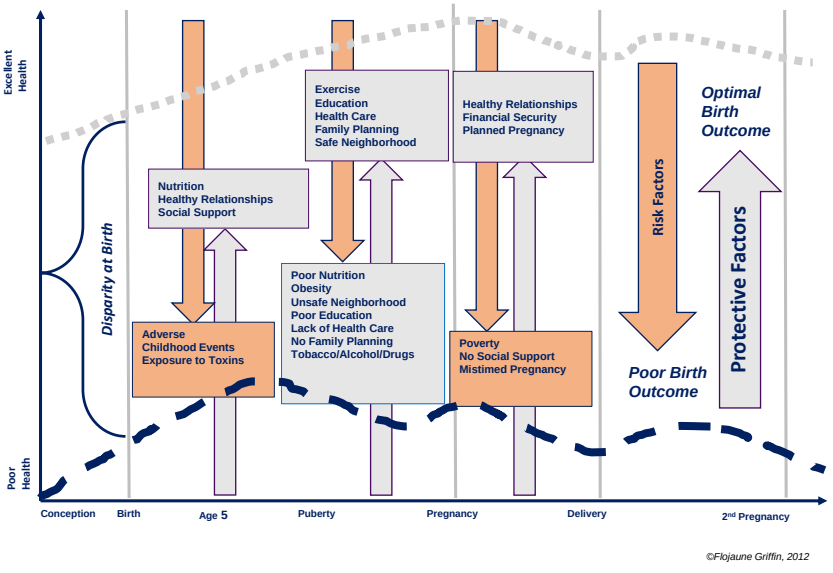


Obesity prevention : a Life Course Approach (to optimize healthy weight)

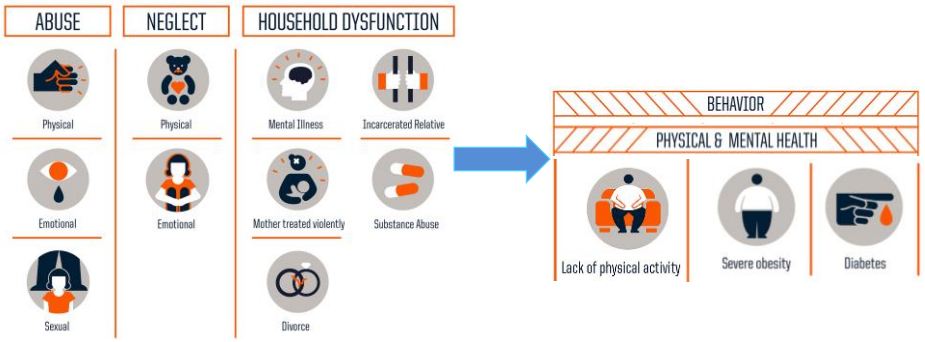


Ecosystem Influences on HD Trajectories

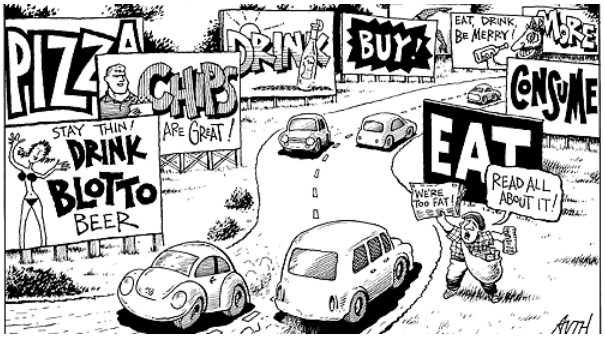




Adverse Childhood Experiences (ACEs)



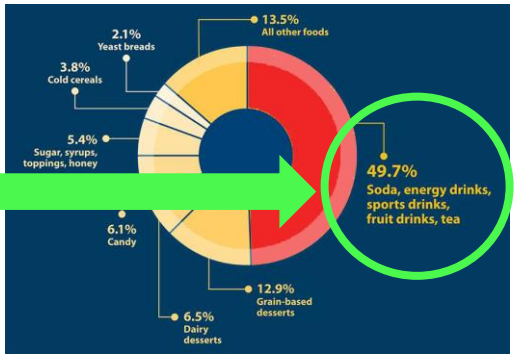
$10 BILLION SPENT ANNUALLY MARKETING FOOD TO CHILDREN



SUGAR SWEETENED BEVERAGES

38.6 Pounds of added sugars from sugar drinks are consumed by the average American each year

Sources of Added sugars

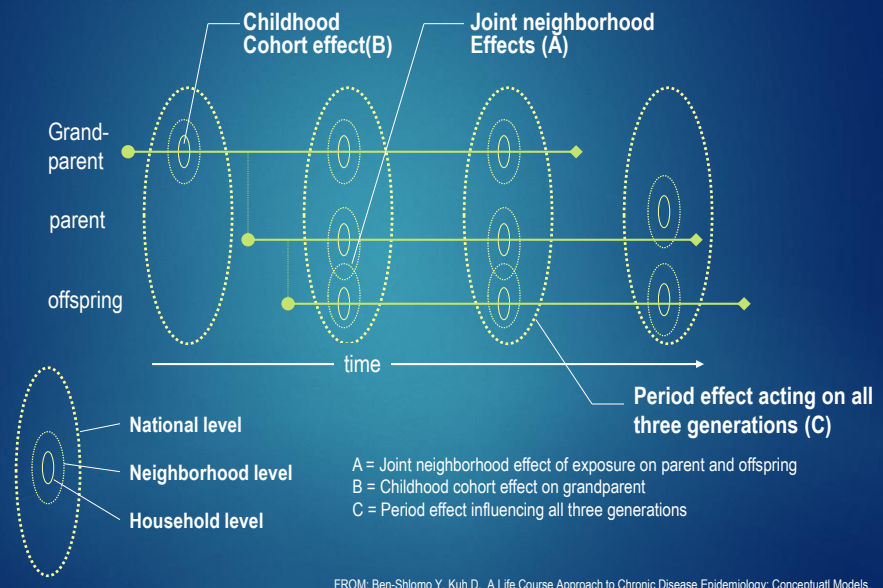


PUBLIC HEALTH ADVOCATES

Designed for Disease

- Demonstrated Link Between Local Food Environments and Obesity and Diabetes
- Higher the ratio of fast-food restaurants and convenience stores to grocery stores and produce vendors the higher the prevalence of obesity and diabetes

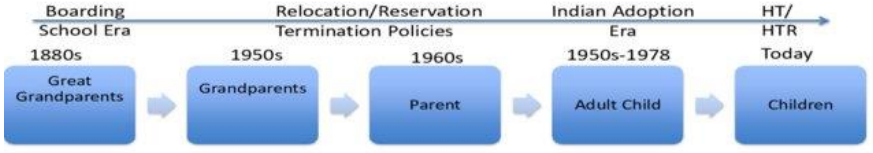
A Multigenerational, Nested, Ecosystem , Life Course Approach >>>>>>>Across three generations



A = Joint neighborhood effect of exposure on parent and offspring
B = Childhood cohort effect on grandparent
C = Period effect influencing all three generations

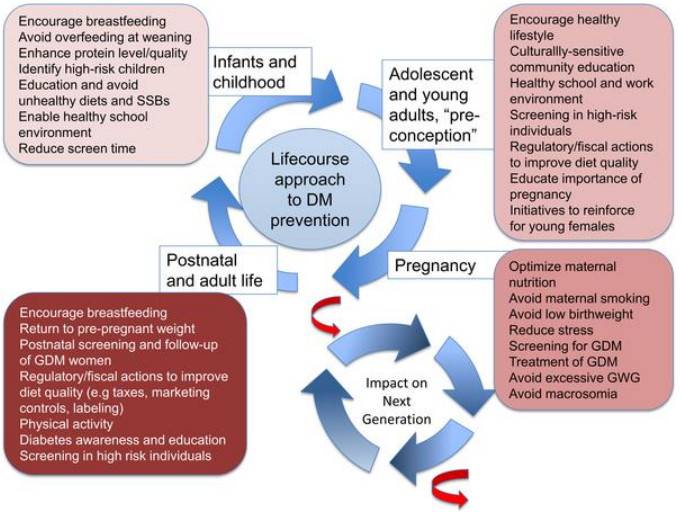
FROM: Ben-Shlomo Y, Kuh D. A Life Course Approach to Chronic Disease Epidemiology: Conceptuatl Models, Empirical Challenges and Interdisciplinary Perspectives. International Journal of Epidemiology. 2002; 31:285-293.

Intergenerational Transmission of Historical Trauma and Loss Map



Myhra, L. L. (2011). " It runs in the family": intergenerational transmission of historical trauma among urban American Indians and Alaska Natives in culturally specific sobriety maintenance programs. *American Indian and Alaska native mental health research (Online)*, *18*(2), 17.

Fig 1. The intergenerational cycle of diabetes and obesity.

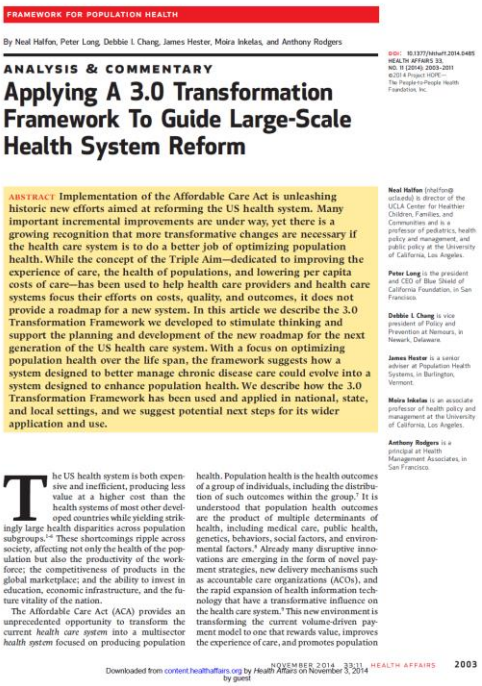


Ma RCW, Popkin BM (2017) Intergenerational diabetes and obesity—A cycle to break?. PLOS Medicine 14(10): e1002415. https://doi.org/10.1371/journal.pmed.1002415
https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002415

PLOS | MEDICINE

The Health Policy Challenge

- Most inefficient, low value, low ROI health system
- Many other challenges
  - Massive health inequalities,
  - Rapidly rising rates of chronic disease
  - Unavoidable demographic shifts
  - Relentless cost increases
- An Anemic and Tired Health Policy Strategy that does not reflect what we know about producing health
- Old Outdated Operating System
  - Mismatch between 3.0 apps and 2.0 goals and 1.0 payment methodology



FRAMEWORK FOR POPULATION HEALTH

By Neal Halfon, Peter Long, Debbie I. Chang, James Hester, Moira Inkelas, and Anthony Rodgers

DOI: 10.1377/hlthaff.2014.0485
HEALTH AFFAIRS 33,
NO. 11 (2014): 2003–2011
©2014 Project HOPE—
The People-to-People Health
Foundation, Inc.

ANALYSIS & COMMENTARY

Applying A 3.0 Transformation Framework To Guide Large-Scale Health System Reform

ABSTRACT Implementation of the Affordable Care Act is unleashing historic new efforts aimed at reforming the US health system. Many important incremental improvements are under way, yet there is a growing recognition that more transformative changes are necessary if the health care system is to do a better job of optimizing population health. While the concept of the Triple Aim—dedicated to improving the experience of care, the health of populations, and lowering per capita costs of care—has been used to help health care providers and health care systems focus their efforts on costs, quality, and outcomes, it does not provide a roadmap for a new system. In this article we describe the 3.0 Transformation Framework we developed to stimulate thinking and support the planning and development of the new roadmap for the next generation of the US health care system. With a focus on optimizing population health over the life span, the framework suggests how a system designed to better manage chronic disease care could evolve into a system designed to enhance population health. We describe how the 3.0 Transformation Framework has been used and applied in national, state, and local settings, and we suggest potential next steps for its wider application and use.

Neal Halfon (nhalfon@ucla.edu) is director of the UCLA Center for Healthier Children, Families, and Communities and is a professor of pediatrics, health policy and management, and public policy at the University of California, Los Angeles.

Peter Long is the president and CEO of Blue Shield of California Foundation, in San Francisco.

Debbie I. Chang is vice president of Policy and Prevention at Nemours, in Newark, Delaware.

James Hester is a senior adviser at Population Health Systems, in Burlington, Vermont.

Moira Inkelas is an associate professor of health policy and management at the University of California, Los Angeles.

Anthony Rodgers is a principal at Health Management Associates, in San Francisco.

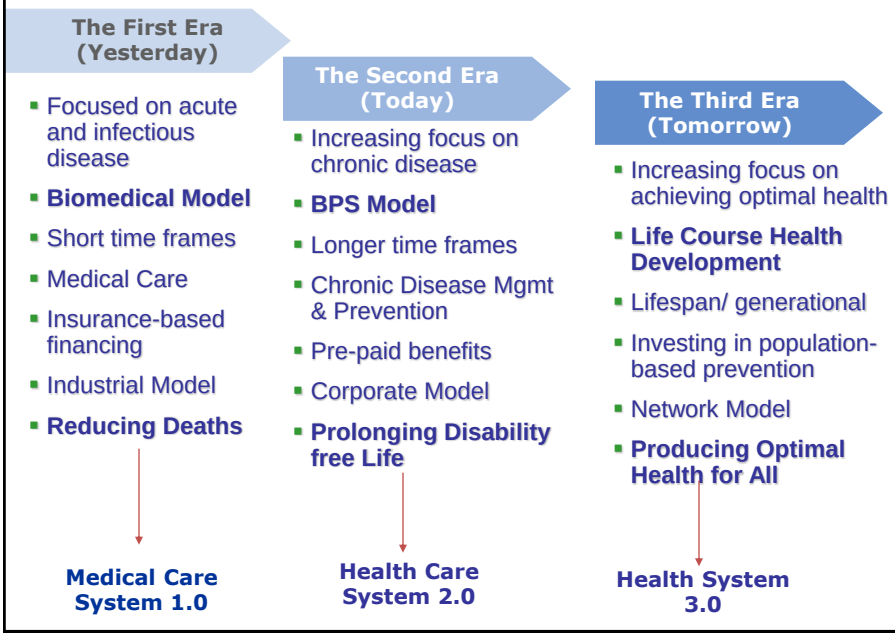
The US health system is both expensive and inefficient, producing less value at a higher cost than the health systems of most other developed countries while yielding strikingly large health disparities across population subgroups.[1,2] These shortcomings ripple across society, affecting not only the health of the population but also the productivity of the workforce; the competitiveness of products in the global marketplace; and the ability to invest in education, economic infrastructure, and the future vitality of the nation.

The Affordable Care Act (ACA) provides an unprecedented opportunity to transform the current *health care system* into a multisector *health system* focused on producing population health. Population health is the health outcomes of a group of individuals, including the distribution of such outcomes within the group.[3] It is understood that population health outcomes are the product of multiple determinants of health, including medical care, public health, genetics, behaviors, social factors, and environmental factors.[4] Already many disruptive innovations are emerging in the form of novel payment strategies, new delivery mechanisms such as accountable care organizations (ACOs), and the rapid expansion of health information technology that have a transformative influence on the health care system.[5] This new environment is transforming the current volume-driven payment model to one that rewards value, improves the experience of care, and promotes population

Basic Storyline

- 3 eras of health care; 3 major transitions
- 1st Era was focused on saving lives through acute care, emergency and rescue care, and public health safety
- 2nd Era was focused on prolonging life and decreasing levels of disability through chronic disease management and secondary prevention
- 3rd Era will focus on optimizing health and well being though … primary prevention, health promotion, community integrated delivery systems

The Evolving Health Care System



Transitioning to a 3.0 Operating Logic

	Old Operating Logic	New Operating Logic
Definition of Health	Absence of Disease	Life Course Development of Capacities and Realizing Potential (IOM2004)
Goal of the Health System	Maintain Health, Prolong Life	Optimize Population Health Development
Client Model	Individual	Individual, Population, Community
Health Production Model	Down Stream & Biomedical	Upstream Focus on Social and Developmental Origins
Intervention Approach	Diagnosis, Treatment and Rehabilitation	Disease prevention, Preemptive Interventions, Health Promotion, Optimization
Integration Strategy	Vertical	V, Horizontal, Longitudinal / Developmental

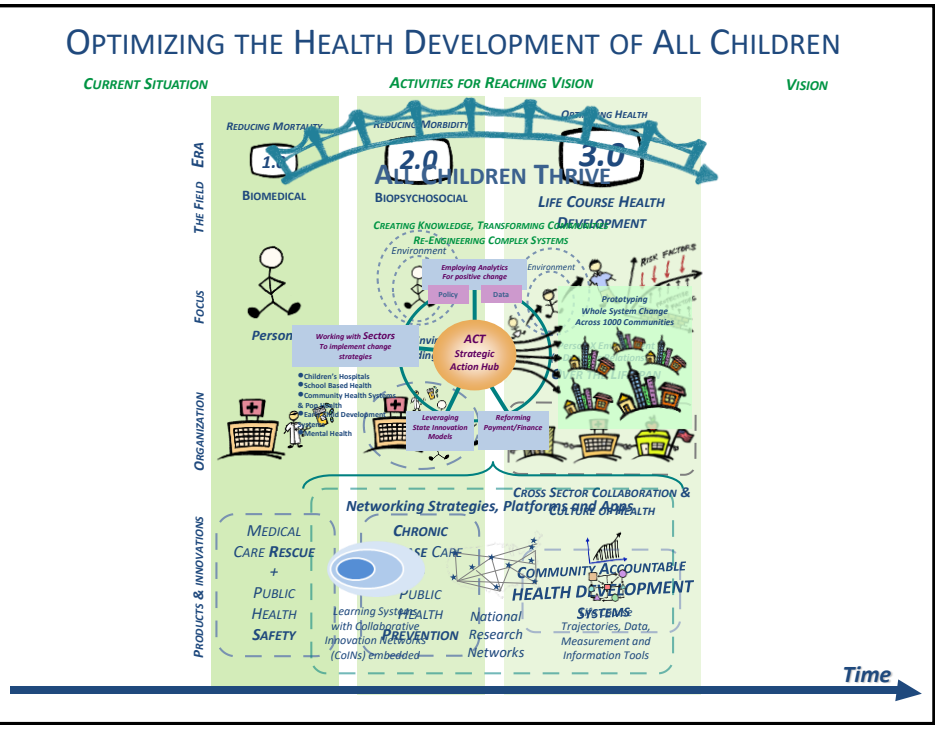
health transformation framework

SYSTEM DESIGN	Health service providers, operating separately	Team-based care within health	Community integrated services, health care as one component
CARE MODEL	Little coordination between in/out patient care, episodic treatment	Chronic condition management, patient-centered care coordination	Health, psychosocial, and wellness care integrated across the life course
DOMINANT PAYMENT APPROACH	Fee-for-service	Value-based health payments	Population-based global budgets, linked to multi-sector financial impact
APPROACH TO QUALITY	Variable, low transparency	Consistent, standardize processes and outcomes	Continuous learning and quality improvement
BENEFICIARY LENS	Individual	Patient and family	Subpopulations and communities, equity- oriented

Halfon et al., 2014. Adapted from Figure 2.

slide 72

All Children Thrive



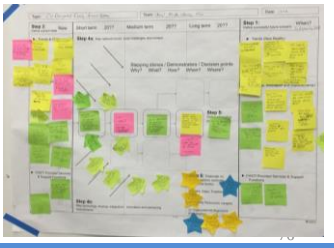
All Children Thrive: What We Can Achieve

- Optimize Health, Development & Well Being
  - Healthy births, school readiness, high school graduation & college going rates
  - Health status, disability rates,
- Improve the conditions and context of childhood
  - Decrease poverty, inequality, adversity,
  - Improve family function, safety, opportunities, neighborhoods, communities
- Improve performance of systems

  Health, education, family support, housing, justice
- Create a sustainable culture of health development, resilience and sustainability for children, youth &

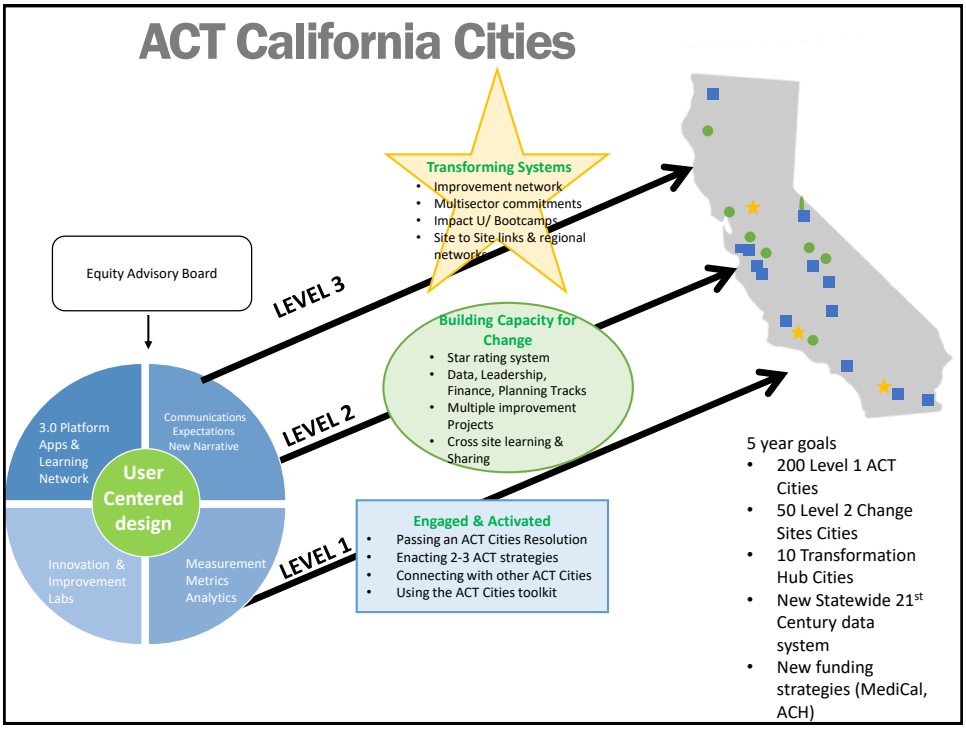
8 Strategies Prioritized & Roadmapped

Strategy Roadmaps
Financing for a Healthy Future
Cross Sector Alignment
Enhancing Communication
Engaging Families & Communities
Engineering Learning Systems
Data & Health Development Metrics
Co-Designed Family Driven Systems
Community Capacity Building



Outcome Measures

- Healthy births
- School readiness
- 3rd Grade reading
- School success
- Mental health
- Higher quality health care
- Fewer unnecessary hospitalizations
- Enhance Child and Family Well being



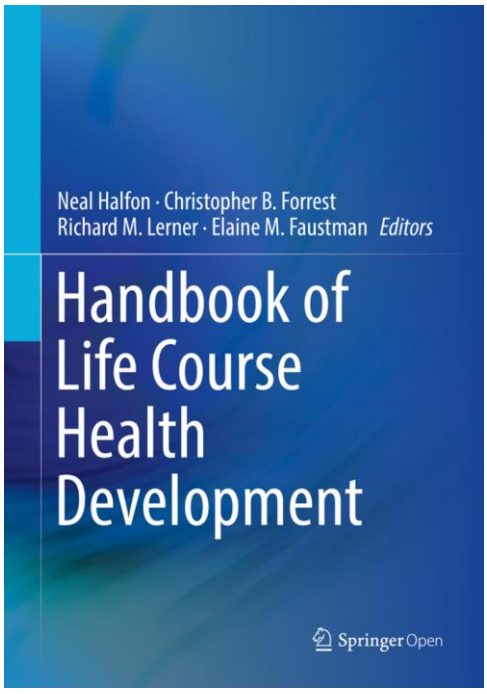
LCHD : Summary

- Life course health development models are emerging
  - New synthesis integrating life course chronic disease epidemiology, developmental neurobiology, psychology, toxicology, epigenetics
  - Not just arraying social determinants but understanding mechanisms, timing, dynamics
- Health development in US is comprised from the start
  - Poorer child health >> more chronic disease and lower Life expectancy
  - Steep social gradients when compared to other nations
  - Obesity epidemic and emerging mental health epidemic are prime examples

LCHD : Summary

- Improving the developmental health and well being of young people is key strategy for reducing health disparities
- Need to consider the fundamental causes (causes of causes) that are creating an enormous mismatch between human developmental plasticity determined by bio-cultural evolution and current environments
- Transforming the US health system and reducing costs will depend on shifting the focus of health production from late in life to early intervention, prevention, and life long health promotion.
- More attention to the developmental and cultural scaffolding, especially the *relational scaffolding*, and not just the services

Find us at
www.lcrn.net


Neal Halfon · Christopher B. Forrest
Richard M. Lerner · Elaine M. Faustman Editors
Handbook of Life Course Health Development
Springer Open